Osteoarthritis and Cartilage (2009) **17,** 1288–1292

doi:10.1016/j.joca.2009.04.002

Osteoarthritis and Cartilage

International Cartilage Repair Society

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The prognostic value of the clinical ACR classification criteria of knee osteoarthritis for persisting knee complaints and increase of disability in general practice

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Summary

Objective: To assess the prognostic value of the clinical American College of Rheumatism (ACR) classification criteria of knee osteoarthritis (OA) on persisting knee complaints and increase of disability in adult patients with knee pain in general practice after 1-year follow-up.

Methods: Patients (aged >35 years) consulting for non-traumatic knee complaints in general practice were enrolled in the study. At baseline and 1-year follow-up knee complaints and function were assessed by questionnaires and a physical examination was performed. The prognostic value of fulfilling the clinical ACR criteria of knee OA at baseline on the outcomes persisting knee complaints and increase of disability was determined.

Results: 549 patients were included in the study of which 480 (87.4%) were available for follow-up. The studied population consisted of 236 (49.2%) women with mean age 53.6 [standard deviation (sd) 11.3], mean body mass index (BMI) 27.1 (sd 4.2), 288 (60.0%) patients had payed employment, and 292 (60.8%) patients fulfilled the clinical ACR criteria of knee OA.
After 1-year follow-up, 236 (49.2%) patients reported persisting knee complaints, and 84 (17.5%) reported an increase of disability.
There was no association of fulfilling the clinical ACR criteria of knee OA at baseline with persisting knee complaints [odds ratio (OR) 1.15; 95% Confidence Interval (CI) 0.80; 1.67] or increase of disability (OR 1.05; 95% CI 0.43; 2.58) at follow-up.

Conclusion: The clinical ACR classification criteria of knee OA have no prognostic value for predicting persisting knee complaints or an increase of disability at 1-year of follow-up in adult patients with non-traumatic knee complaints in GP.

Key words: Clinical ACR criteria, Prognostic value, Nontraumatic knee complaints, General practice.

Introduction

Musculoskeletal diseases are one of the major causes of disability around the world and have important consequences to the individual and society. Within musculoskeletal diseases, rheumatoid arthritis, osteoarthritis (OA) and back pain are the most important causes of disability[1].

Although musculoskeletal pain and dysfunction affect all ages, the elderly are particularly targeted[2,3]. The clinical syndrome of joint pain and stiffness in older people is the most common cause of disability and healthcare consultation in this age group[4].

In general practice, knee complaints (traumatic and non-traumatic) take second place after back pain in the prevalence of musculoskeletal disorders (48/1000 patients per year), mostly presented as knee pain or functional loss of the knee joint[5,6]. About 60% of patients with non-traumatic knee complaints is aged over 25 years. Disorders most diagnosed within this group in primary care are bursitis, tendonitis and OA[5]. In the elderly, the most common cause of knee complaints is the presence of OA[7].

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Received 12 September 2008; revision accepted 3 April 2009.

In spite of the high prevalence of knee complaints in general practice, few studies have investigated the symptomatic course of non-traumatic knee complaints in general practice[8–10]. In a previous study we reported that almost 50% of patients visiting their general practitioner (GP) with incident knee complaints had persisting or worse knee complaints after 1-year follow-up[8]. In that study, especially complaint characteristics (e.g., bilateral symptoms, duration of symptoms) were the strongest predictors of persisting knee complaints at 1-year follow-up[8].

In clinical practice, it would be helpful to be able to distinguish between different groups of knee conditions with different effective treatment pathways, different courses and different prognoses, and subsequently inform the patient about the course of the disease.

To standardize the clinical definition of OA, the American College of Rheumatism (ACR) developed classification criteria especially with the aim to create standardized definitions for inclusion in trials and cohort studies[11]. For knee OA, Altman *et al.* developed these criteria to classify clinical OA, clinical and radiographic OA, and clinical and laboratory OA[12].

Considering the fact that knee OA is thought to be a chronic condition, it would be of interest to assess the prognostic value of clinical ACR criteria (combined sets) for knee OA instead of the prognostic value of individual characteristics separately. A combined set of characteristics developed to

classify knee OA might have a higher prognostic value than individual characteristics.

Until now no studies investigating the prognostic value of fulfilling the ACR criteria on the prognosis of non-traumatic knee complaints in general practice are available.

Therefore, we performed a prospective cohort study in general practice to assess the prognostic value of fulfilling the ACR criteria on persisting or worsening knee complaints, and an increase of disability at 1-year follow-up in patients visiting the GP with non-traumatic knee complaints. Additionally we will describe how the ACR criteria are distributed in a primary care population with new non-traumatic knee complaints.

Methods

STUDY DESIGN AND POPULATION

For this study, a subgroup of the prospective Huisartsen Onderzoek Netwerk Erasmus Universiteit Rotterdam (HONEUR) knee cohort was used; details on this cohort have been reported earlier[13]. In brief, consecutive patients of age $\geq$ 12 years visiting their (GP) with a new episode of knee complaints were enrolled in the study and followed for 1 year. In this prospective cohort study, 40 GPs from five municipalities in the southwest region of the Netherlands, connected to the Erasmus MC GP Research Network HONEUR and representing a total patient population of around 84,000 patients, participated. Recruitment was started in October 2001 in one municipality and a new municipality was added approximately every 3 months. All GPs recruited up to October 2003[13]. New complaints were defined as complaints that were presented to the GP for the first time in a period of 3 months. Recurrent complaints for which the GP was not consulted within the last 3 months were also considered as new complaints. Exclusion criteria were knee complaints that required urgent medical attention (fractures, infection), patients with malignancies, neurological disorders or systemic musculoskeletal diseases (e.g., Parkinson's disease, rheumatoid arthritis, amyotrophic lateral sclerosis), as well as incapability of understanding the implications of participation. At baseline and at 1-year follow-up, patients underwent a standardized physical examination of their knee by trained physiotherapists. The physical examination at baseline was planned as close to the date of consultation of the GP as possible.

For this study, all patients aged 35 years and older with non-traumatic knee complaints were included. At baseline and 12-month follow-up, information on knee complaints (duration, intensity), daily activities and social circumstances was collected and a physical examination of the knee was performed. In patients with bilateral complaints, both knees were examined. For the analysis, the self-nominated worst knee was used.

Functional disability and pain were assessed both at baseline and 12-month follow-up by self-reported questionnaires containing the Western Ontario and McMasters University Osteoarthritis Index (WOMAC)[14,15], the Medical Outcome Study Short Form-36 (SF-36)[16,17], the Knee Society Score (KSS) function questions[18,19], the Lysholm Knee Scoring Scale[20–22], the Tampa Scale for Kinesiophobia (assessed at baseline)[23,24].

The physical examination included signs (e.g., swelling, temperature) and symptoms (e.g., function, pain) of the knee and hip. Further details about the physical signs and how they were elicited and scored are available from the corresponding author.

For the outcome persisting knee complaints at 1-year follow-up, a question addressing experienced recovery or worsening scored on a 7-point Likert scale was added to the last questionnaire.

STATISTICAL ANALYSIS

First, we assessed which patients fulfilled the clinical ACR criteria of OA as described by Altman *et al.*[12]. Clinical OA of the knee is defined as knee pain and at least three out of six of the following criteria: age $>$ 50 years, morning stiffness $<$ 30 min, crepitus, bony tenderness, bony enlargement, and no palpable warmth.

Differences between patients fulfilling the clinical ACR criteria and patients not fulfilling these criteria were assessed.

Hereafter, we univariately analyzed the association of fulfilling the clinical ACR criteria and age, gender, body mass index (BMI), and disability (WOMAC function score) at baseline.

To assess the prognostic value of the clinical ACR criteria, we first univariately assessed the association with persisting knee complaints, and an increase of disability after 1-year follow-up. Additionally, the enter method of logistic regression or linear regression was used to adjust for differences in patient characteristics and baseline severity.

Persisting knee complaints were defined as patients who experienced knee complaints as somewhat better, no recovery, worse, much worse, or worse than ever, vs recovered patients who experienced knee complaints as much better and no complaints after 1-year follow-up. The increase of disability was assessed by the difference between WOMAC function score at baseline and 1-year follow-up.

SPSS software version 11 was used to analyze the data. For the missing data of participants available for follow-up at 1 year, a Multiple Imputation Bu Chained Equations (MICE) was used[25] for the 1-year outcome data or relevant baseline information (e.g., persistent knee complaints, WOMAC function score).

Results

STUDY POPULATION

A total of 549 patients aged $\geq$35 years with non-traumatic knee complaints were included, of which 480 were available for follow-up. Persons lost to follow-up ($n = 69$; 12.6%) showed no significant differences compared with those not lost to follow-up regarding baseline age, gender, BMI, KSS knee and function score, SF-36 score, co-morbidity, WOMAC scores, Lysholm scores, Tampa scores, and knee OA according the clinical ACR criteria.

Of the persons lost to follow-up, reasons for not participating any more were lack of time/lack of interest ($n = 36$, 52.2%), severe co-morbidity like cancer or cerebrovascular accident ($n = 15$, 21.7%), treatment by an orthopedic surgeon ($n = 4$, 5.8%). Further, 14 patients (20.3%) provided no reason.

The mean age was 53.6 (sd 11.3) years, mean BMI was 27.1 (sd 4.2), and 236 (49%) were women. Table I presents details on the characteristics of the study group. Detailed information about baseline characteristics (e.g., KSS knee and function scores, Tampa scale for Kinesiophobia) is reported earlier[8].

After 1-year follow-up, 236 (49.2%) patients reported persisting knee complaints, and 84 (17.5%) reported an increase of disability (mean difference 13.9, sd 20.3).

With regard to the missing values, multiple imputation was used to replace the missings. There were both eight missing values of the dependent variable 'persistent knee complaints' and 'increase of disability'. Of the patient characteristics, complaint characteristics, and the characteristics of physical examination, the range of missing values was 3–20.

CLINICAL ACR CRITERIA

Of the 480 included patients, 292 (61%) fulfilled the clinical ACR criteria of OA. Of these, besides knee pain, 123 (26%) fulfilled three out of six, 109 (23%) fulfilled four out of six, 50 (10%) fulfilled five out of six, and 10 (2%) fulfilled all clinical ACR criteria.

One of the six ACR criteria is age $>$ 50 years. But also in the patients aged $\leq$50 years, 72 of 232 patients (31%) fulfilled the (other) clinical ACR criteria. Of these, 59 (81%) had a traumatic history of the knee in the past. With increase in age, also the percentage of patients who fulfilled the ACR clinical criteria increased (Table II).

COMPARISON WITH PATIENTS WITHOUT OA (TABLE I)

In the univariate analysis, fulfilling the ACR criteria at baseline was associated with increasing age, female gender, increasing BMI, and more disability (increase of WOMAC function score) at baseline.

Also, patients fulfilling the ACR criteria differed statistically significant from patients not fulfilling these criteria on a history of (non)traumatic knee complaints, limited when walking stairs, self-reported swollen knee joint, pain of internal rotation of the hip, restriction of internal rotation of the hip, and WOMAC function score at follow-up.

Table I
Study population characteristics (n = 480)

Characteristic	OA (ACR criteria) ($n = 292$)	No OA ($n = 188$)	OR (95% CI)	Total ($n = 480$)
Baseline				
Age; mean (sd)	57.2 (10.4)	47.9 (10.2)*	1.10 (1.07; 1.12)	53.6 (11.3)
Female gender; *n* (%)	158 (54.1)	78 (41.5)*	1.60 (1.10; 2.32)	236 (49.2)
BMI; mean (sd)	27.6 (4.4)	26.3 (3.8)*	1.08 (1.03; 1.13)	27.1 (4.2)
Duration of complaints; *n* (%)				
<3 weeks	124 (42.5)	83 (44.1)	1.00	207 (43.1)
3 weeks to 3 months	83 (28.4)	53 (28.2)	0.73 (0.40; 1.32)	136 (28.3)
3 months to 1 year	42 (14.4)	28 (14.9)	0.77 (0.41; 1.43)	70 (14.6)
>1 year	43 (14.7)	21 (11.2)	0.73 (0.36; 1.49)	64 (13.3)
WOMAC function score; mean (sd)†	30.8 (20.6)	21.8 (20.8)*	1.02 (1.01; 1.03)	27.4 (21.1)
WOMAC pain score; mean (sd)†	31.6 (18.8)	26.2 (18.1)*	1.02 (1.01; 1.03)	29.2 (18.7)
Knee complaints affects performance at work; *n* (%)	89 (30.5)	64 (34.0)	1.21 (0.82; 1.79)	153 (31.9)
ACR criteria; *n* (%)				
- Knee pain	292 (100)	167 (88.8)	NA	459 (95.6)
- Age > 50 years	220 (75.3)	54 (28.7)*	7.41 (4.90; 11.21)	273 (56.9)
- Stiffness < 30 min	195 (66.8)	39 (20.7)*	7.36 (4.80; 11.57)	234 (48.8)
- Crepitus	210 (71.9)	58 (30.9)*	4.24 (2.61; 6.89)	268 (55.8)
- Bony tenderness	206 (70.5)	43 (22.9)*	8.08 (5.29; 12.33)	249 (51.9)
- Bony enlargement	45 (15.4)	7 (3.7)*	4.74 (2.09; 10.76)	52 (10.8)
- No palpable warmth	239 (81.8)	121 (64.4)*	2.36 (1.54; 3.64)	360 (75.0)
History of traumatic knee complaints in the past; *n* (%)	176 (60.3)	89 (47.3)*	1.68 (1.03; 2.76)	265 (55.2)
History of non-traumatic knee complaints in the past; *n* (%)	53 (18.2)	13 (6.9)*	3.25 (1.70; 6.19)	66 (13.8)
Limited when walking stairs; *n* (%)	254 (87.0)	129 (68.6)*	2.85 (1.79; 5.54)	383 (79.8)
Self-reported swollen knee joint; *n* (%)	130 (44.6)	62 (33.0)*	1.61 (1.10; 2.36)	197 (39.5)
Other physical examination; *n* (%)				
- Effusion knee joint (ballottement)	100 (34.2)	51 (27.1)	1.28 (0.83; 1.96)	151 (31.5)
- Pain active extension	54 (18.5)	23 (12.2)	0.83 (0.47; 1.47)	180 (37.5)
- Pain active flexion	121 (41.4)	59 (31.4)	0.81 (0.51; 1.30)	77 (16.0)
- Pain internal rotation hip	54 (18.5)	18 (9.6)*	2.15 (1.22; 3.81)	72 (15.0)
- Restriction internal rotation hip	77 (26.4)	34 (18.1)*	1.62 (1.03; 2.55)	111 (23.1)
- Patellofemoral apprehension test	57 (19.5)	11 (5.9)*	3.89 (1.98; 7.65)	68 (14.2)
Bursitis prepatellaris; *n* (%)	44 (15.1)	22 (11.7)	1.34 (0.77; 2.32)	66 (13.8)
Pain iliotibial tract; *n* (%)	50 (7.1)	20 (10.6)	1.71 (0.98; 2.98)	70 (14.6)
Pain ligamentum patellae; *n* (%)	32 (11.0)	17 (9.0)	1.30 (0.77; 2.18)	49 (10.2)
Pain borders patella; *n* (%)	145 (49.6)	64 (34.0)*	2.00 (1.37; 2.93)	281 (43.5)
Pain tuberositas tibiae; *n* (%)	30 (10.3)	6 (3.2)*	3.41 (1.39; 8.38)	36 (7.5)
After 1-year follow-up				
Persistent knee complaints; *n* (%)	148 (50.7)	88 (46.8)	1.15 (0.80; 1.67)	236 (49.2)
WOMAC function score; mean (sd)†	16.3 (19.7)	9.0 (14.7)*	1.02 (1.01; 1.04)	13.3 (18.3)
WOMAC pain score; mean (sd)†	15.6 (18.9)	9.9 (14.8)*	1.02 (1.01; 1.03)	13.7 (17.7)
Increase in disability; *n* (%)	54 (18.5)	30 (16.0)	1.20 (0.73; 1.95)	84 (17.5)
Knee complaints affects performance at work; *n* (%)	36 (12.3)	27 (14.4)	0.86 (0.50; 1.47)	63 (13.1)

* Statistical significant difference ($P < 0.05$) compared to presence of OA (ACR criteria).
†WOMAC (scale 0−100), a lower score represents better function/outcome.

Further, patient fulfilling the clinical ACR criteria had more serious complaints and co-morbidity, and differed statistically significant on pain of the borders or the patella, and pain of the tuberositas tibiae.

As a result of the classification, all separate ACR criteria were more often present in patients fulfilling the clinical ACR criteria.

PROGNOSTIC VALUE OF THE CLINICAL ACR CRITERIA

For the prognostic value of fulfilling the ACR criteria, there was univariately no association with persisting knee complaints (OR 1.15, 95% CI 0.80; 1.67) or an increase of disability [Beta 0.03 (95% CI −0.05; 0.10)] after 1-year follow-up. Adjustment for age, gender, BMI, and baseline severity (WOMAC function and pain) did not change the found association.

Discussion

In the present study the ACR clinical classification criteria of knee OA had no prognostic value for predicting persisting or worsening knee complaints or an increase of disability in adult patients with non-traumatic knee complaints in general practice after 1-year follow-up.

This study also showed that patients fulfilling the ACR criteria of clinical knee OA had more serious complaints (lower WOMAC function and pain score) and co-morbidity at baseline and after 1-year follow-up.

Despite the high prevalence of knee complaints in general practice[6], the prognostic value of the ACR clinical classification criteria of knee OA has received little attention.

We found that the clinical ACR criteria of knee OA have no prognostic value. A plausible reason for the absence

Table II
OA (ACR) in 10-year age groups (n = 480)

Age (years)	OA; *n* (%)	No OA; *n* (%)	Total; *n*
35–45	41 (29.7)	97 (70.3)	138
46–55	99 (65.1)	53 (34.9)	152
56–65	82 (78.1)	23 (21.9)	105
66–75	57 (83.8)	11 (16.2)	68
76–85	13 (76.5)	4 (23.4)	17
Total	292 (60.8)	188 (39.2)	480

of the prognostic value of the ACR clinical classification criteria may be that the follow-up of 1 year is too short to show a difference between both groups. One-year follow-up could be too short to discriminate between the knee OA and the other diagnoses in primary care and more pronounced differences might show up after a longer period of follow-up (e.g., >5 years). A follow-up after 7 years is planned for the HONEUR knee cohort.

Also, the fluctuating course of symptoms of knee OA[5] might provide noise and regression to the mean.

Compared to a secondary care population, our population had less severe complaints and knee function was better[26]; this might lead to less pronounced findings than in a secondary care population. Also in secondary care, patients with knee complaints based on OA have to be distinguished from among other things rheumatoid arthritis, arthralgia or fibromyalgia, osteonecrosis, meniscal or ligamentous or cruciate abnormalities, osteonecrosis, and septic arthritis[12]. This in contrast with patients in primary care where besides knee OA the differential diagnosis of non-traumatic knee complaints mainly consists of a bursitis prepatellaris, iliotibial tract syndrome, and soft tissue disorders[5] because of the low incidence of rheumatoid arthritis, septic arthritis, and osteonecrosis (e.g., considerable effusion will appear less often due to the low percentage of rheumatoid arthritis). Also, exclusion criteria of our study were among others infection of the knee joint or the presence of rheumatoid arthritis. Therefore, the criterion 'no palpable warmth' might discriminate in secondary care but probably not or even the other way around in primary care. However, even if we did not include the ACR criterion 'no palpable warmth' the clinical ACR criteria still had no prognostic value on persisting knee complaints or an increase of disability in adult patients with non-traumatic knee complaints in general practice after 1-year follow-up.

Further, in our study, recurrent complaints for which the GP was not consulted within the last 3 months were also considered as new complaints. We also performed the analysis for the subgroup of patients who never consulted for knee pain before, but we did not find other results for this group. Therefore, we do not expect bias due to the inclusion criteria used.

Patients classified with clinical OA had statistically significant more serious complaints at baseline and follow-up and showed more co-morbidity of the knee (lower WOMAC pain and function scores, higher prevalence of pain of the iliotibial tract, pain of the borders of the patella, and pain of the tuberositas tibiae). This might indicate that besides knee OA also other disorders contribute to the knee complaints making it more difficult to distinguish the specific signs and symptoms of knee OA.

For the outcome we used patients' self-reported recovery or persisting knee complaints at 1-year follow-up compared with those at baseline. Such self-reports may be susceptible to recall bias[27]. However, response shifts in different directions may have a similar meaning when comparing patient groups who deteriorated or improved[27].

In our study the physical examination was performed by trained physiotherapists according to a standardized test protocol[13]. Standardization of the examinations among researchers was accomplished by a series of training sessions before starting the inclusion of patients and these sessions were repeated regularly over the course of the inclusion period[13]. In our study, we don't have information about the reliability of the physical examination.

But, a study about the reliability of physical examination in knee OA reported that, with exception of physical examination for instability, a comprehensive knee examination can be performed with adequately reliability and that standardization further improves the reliability for some physical signs and techniques (e.g., alignment, bony swelling)[28].

In clinical practice, however, due to lack of standardization of the examination of the knee joint, the ACR criteria obtained by the physical examination, e.g., bony enlargement in overweight people, might be less reproducible and valid to assess.

In our study, 61% of the patients fulfilled the clinical ACR criteria of knee OA. This is in contrast with the study by Peat *et al.* where 30% of the participants fulfilled the clinical ACR criteria of knee OA[29]. A reason for this difference might be that in the study by Peat *et al.* patients were recruited by postal surveys in the open population addressing knee pain in the last 12 months. This is a major difference with our study in which patients visiting their GP with incident non-traumatic knee pain were included.

Another reason for the high percentage of patients fulfilling the clinical ACR criteria could be that the criterium 'no palpable warmth' would more often be fulfilled because we did not include patients with an infection of the knee joint or rheumatoid arthritis. But even if we did not include this criterium, there still was a higher percentage of patients fulfilling the clinical ACR criteria (42%).

With regard to the clinical ACR criteria of knee OA, doubts have been expressed about the validity of these criteria in primary care or the general population[29,30].

Peat *et al.* report the ACR criteria seem to reflect later signs in advanced disease[29]. In their study the combination of frequent knee symptoms and radiographic evidence of definite OA was used to assess the performance of the ACR criteria of knee OA in the general population. Also, in our study, especially specific later signs of knee OA like bony enlargement are more prevalent in patients fulfilling the clinical ACR. Another striking observation is that most patients ≤50 years fulfilling the clinical ACR criteria report a history of traumatic knee complaints. This is in accordance with previous studies who reported knee trauma to be a risk factor for incident knee OA[31,32], especially for knee OA at younger age.

Also, with respect to the WOMAC scores in primary care, there is increasing uncertainty about the validity and reliability of this questionnaire[33,34]. One can suppose that some patients were considered wrongly as suffering from an increased disability, while the increase in WOMAC score was due to the reliability of measurement. However, we do not expect bias due to the reliability of the measurement. Because, it is also possible that some patients were considered wrongly as decreased disability due to the reliability of the measurement.

In conclusion, this study shows the absence of the prognostic value of the ACR clinical classification criteria of knee OA for predicting persisting knee complaints and an increase of disability after 1-year follow-up in adult patients

consulting their GP with incident knee complaints. Further studies should establish whether the present clinical ACR criteria do have prognostic value at longer follow-up or whether ACR criteria are valid for use in primary care.

Conflict of interest

None of the authors have any financial and personal relationships with other people or organizations that could influence (bias) their work.

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